SYNTHESIZED FM STEREO TRANSMITTER

Ramsey Electronics Model No. MP3FM

Own the Hottest FM Stereo broadcast station around and play the music you want to play! The MP3FM turns your computer into an MP3 transmitter.
Why limit your hours worth of downloading to listening in front of your computer, now you can enjoy the fruits of your labor from anywhere in your home!

- **Great for transmitting your MP3 or WAV files throughout the house, yard or even your car.**
- **Fantastic audio quality; sounds better than most stations on the dial. And we'll tell you why!**
- **Enjoy PC Gaming with BOOMING sound from your stereo system.**
- **Easily connects to the line or speaker level outputs on any sound card, tape deck, stereo system, or CD player.**
- **Special "loop through" design allows you to keep your computer speakers connected; broadcast or listen directly with no rewiring.**
- **Operates on 8 to 14 volts DC, 12 volt DC power supply provided.**
- **Easily tunable anywhere in the 88-108 MHz FM band.**
- **Clear, concise instructions guide you step-by-step to a finished product that works FIRST time.**

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SYNTHESIZED MP3FM STEREO TRANSMITTER KIT INSTRUCTION MANUAL
Ramsey Electronics publication No. MMP3FM Rev 2.3
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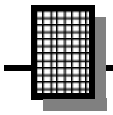

KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR

SYNTHESIZED FM STEREO TRANSMITTER KIT

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INTRODUCTION

Until now, you had to play back all the great music and fun sound effects files you downloaded to your home computer right on the PC. While some people have high end, good quality speakers for their computer, most of us use speakers that are not.

The Ramsey MP3FM is a true SYNTHESIZED STEREO FM broadcast transmitter, which any person may build and use in accordance with the rules of your nation's telecommunications authority. For U.S. residents, that authority is the Federal Communications Commission (FCC). The MP3FM's low-power broadcasting capability and other practical uses can be fun and interesting for people of all ages, but the MP3FM is definitely not a toy. We will refer to the FCC regulations frequently in this manual and provide you with some information necessary to enjoy the MP3FM's capabilities in accordance with the law.

We think you will be very pleased with the transmitting range, audio quality, frequency stability and stereo channel separation of this build-it-yourself synthesized FM stereo transmitter. If you follow our assembly directions carefully and use your MP3FM in accordance with applicable FCC rules, a whole new world of sharing music, news and views right from your PC awaits you.

CIRCUIT DESCRIPTION

We will begin by talking about the power supply of your new MP3FM. While a DC power source is provided with the MP3FM, the DC isn't 'clean' enough to provide us with the low-noise, stable supply that we would like for good audio quality. Voltage regulators VR2 and VR3 provide us with a means to take the raw DC output from the wall transformer and condition it to be a noise free supply. Filter capacitor C5, in conjunction with the isolation filter formed by C40, C41,L4 and L5, reduce ripple noise from the DC wall transformer and aid VR2 and VR3 to provide us with a good clean +3 and +5 volts for the ICs.

The custom FM stereo IC (U3) is the heart of the MP3FM. The control of U3 is determined by its surrounding circuitry. Potentiometers R16 and R17 allow for adjustment of the input audio levels. Resistors R18 and R19 set the pre-emphasis characteristics (75 µs for USA, 50 µs for Europe). R11 permits adjustment of stereo balance and L1 and D14 form an adjustable resonant circuit to set the carrier operating frequency. X2, C22, and C23 provide the 38 KHz subcarrier for stereo transmission. C24, R20, R21 and C25 set the proper multiplexed audio carrier levels for the modulator. The combined modulated RF signal is seen on pin 7 of U3, and is amplified by Q2 and surrounding biasing components.

After Q2 amplifies the RF output of U3. The signal is fed to U1 through C36 and R28. The signal is sampled in this manner as feedback for the PLL to compare the RF transmit signal to that of the PLL crystal, more on the PLL circuit in a few moments. The amplified RF output of Q2 is also fed to Q3 through C35 and R10. Q3 provides further amplification before the signal goes through a low pass filter. The low pass RF filter consisting of C37, L2, C38, L3, and C39 allows the fundamental (operating) frequency to pass through while rejecting any unwanted harmonics. Harmonics are multiples of the desired fundamental frequency and in this case, they can cause unwanted emissions in critical areas of the RF spectrum. A cleaner RF output means happier neighbors and the piece of mind you are not causing unwanted interference.

U2 acts as the brains of the whole circuit. This micro-controller looks at the settings of each of the dip switches S3 through S5 one at a time and from these it calculates the desired frequency. The switches allow you add up the closed (down) positions 1, 2, 4, and 8 to make any number between 0 and 9. For example closing position 1 and 8 on S3 (10 MHz switch) is equal to 90 MHz. Closing 1 and 4 on S4 (1 MHz switch) is equal to 5 MHz. Closing 2 and 1 on S5 (0.1 MHz switch) is equal to 0.3 MHz. This makes the final frequency equal to 95.3 MHz. These switches may be set to any frequency between 88 and 108 MHz. To set the frequency above 100 MHz, the S3 positions must add up to ten. Any switch setting greater than 9, with the exception of S3, is invalid and will be read as 0.

Once this frequency is determined, the information needed to control U1 is sent

serially from U2. This information is a string of binary data, (1's and 0's). In this way data is sent one bit at a time to U1. The frequency information takes 16 bits, and there are an additional 32 bits sent for the internal control of U1. You may think that all this would take a long time but in fact the whole process from the time you press the program switch until the data is completely sent is less than 1/100th of a second!

U1 is a phase locked loop (PLL) synthesizer IC. It takes the 6 MHz crystal frequency and divides it by 60 to obtain a stable reference frequency of 100KHz. How does it know to divide the crystal frequency by 60? That is part of the data that is sent from U2 each time the program button is pressed or the loop is out of lock. U1 also takes the output frequency of U3, and divides it by a number (N). N is the frequency data that was sent by U2. N is always equal to the desired frequency in megahertz times 10.

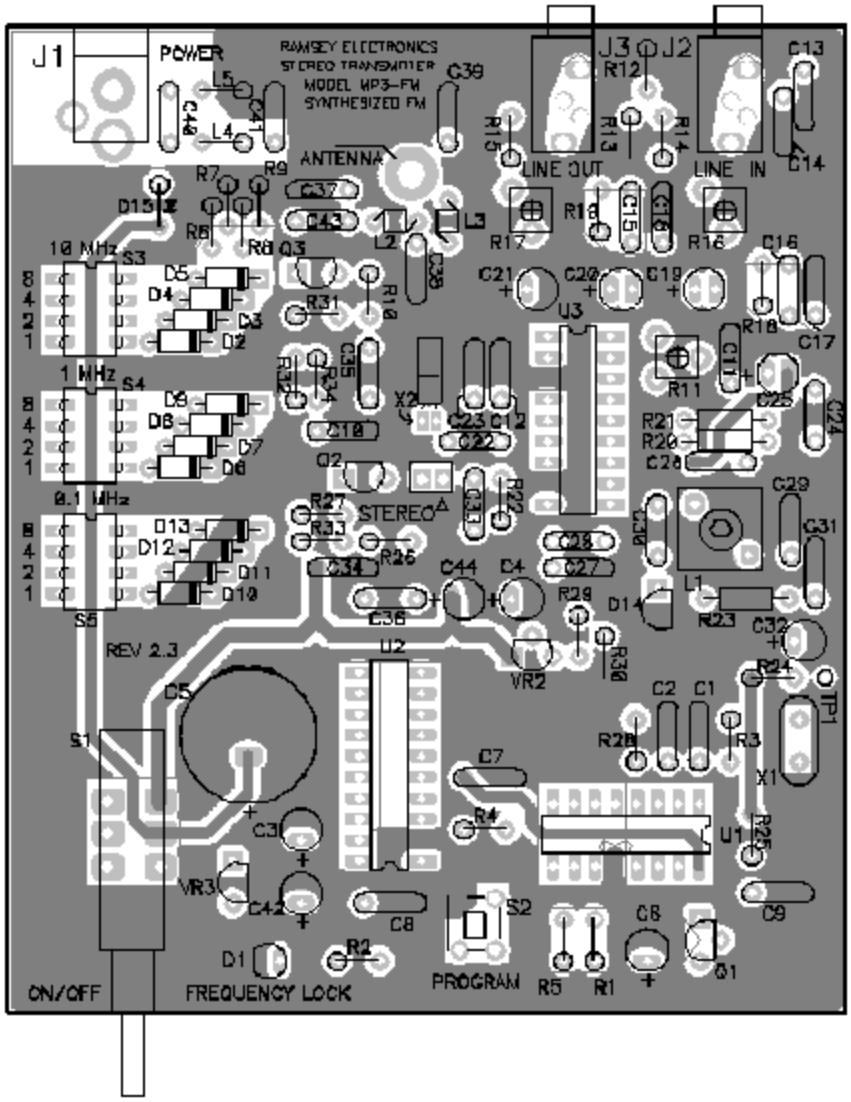
Using the example from above, a frequency of 95.3 MHz gives an N of 953, so the frequency from U3 is divided by 953 and then compared with the reference frequency of 100 KHz. If the desired frequency is less than the reference frequency U1 increases the output voltage on pin 13. This increases the voltage across diode D14, a varactor diode. As the voltage across the varactor increases, it causes a decrease in capacitance (Increasing reverse bias essentially increases the distance between the capacitor's plates by increasing the depletion region in the diode (C = kA/d). The decrease in capacitance causes an increase in U3's RF oscillator ($f_o = 1/[2\pi (LC)^{½}]$), bringing the MP3FM's output frequency back on frequency. If the desired frequency is higher than the reference, pin 13 is driven low. If the frequency is just right then pin 13 becomes a high impedance, basically disconnecting it from the circuit so it will cause no change in the voltage on D14. The voltage changes on pin 13 are filtered by R25, C31, R24, and C32 to provide a steady, noise free tuning voltage for D14. In this way the output frequency of U3 is "locked" to that desired by U2. When the frequency is locked, U1 will cause led D1 to be brightly lit. If D1 is dim or off there is a problem and the frequency is not locked. If the frequency starts to drift for any reason (such as a temperature change) then U1 instantly corrects the tuning voltage to bring it back to the proper frequency.

Notes on Operation

Any time the unit is turned "on" or the "program" switch is pressed the microcontroller reads the frequency switches and sends the data to U1.

To change the frequency simply set the switches to the desired frequency and press "program". The frequency is limited to within 88 to 108 MHz. Any setting outside this range will be programmed as 88.1 MHz. If you set your frequency and press program but don't hear the signal on the frequency you expected try listening on 88.1 MHz. This default setting indicates a problem to the user such as an incorrect switch setting or a possible build error near the switches.

MP3FM PARTS LAYOUT DIAGRAM



PARTS SUPPLIED WITH MP3FM TRANSMITTER KIT

Capacitors

- ❒ 11 .001 µF disc capacitors (marked .001, 102 or 1nF) [C12,13,14,26,29,33,35,36,40,41,43]
- ❒ 6 .01 µF disc capacitors (marked .01 or 103 or 10 nF) [C8,10,17,18,30,34]
- ❒ 4 .1 µF disc capacitor (marked .1 or 104 or 100 nF) [C7,9,11,31]
- ❒ 2 .022 uF ceramic capacitors (marked .022 or 223) [C15,16]
- ❒ 2 5 pF disc capacitors (marked 5 or 5K) [C27,28]
- ❒ 2 10 pF disc capacitors (marked 10 or 10K) [C22,23]
- ❒ 2 27 pF disc capacitors (marked 27 or 27K) [C1,2]
- ❒ 2 47 pF disc capacitors (marked 47) [C37,39]
- ❒ 1 75 pF disc capacitor (marked 75 or 75K) [C38]
- ❒ 1 220 pF disc capacitor (marked 220 or 221) [C24]
- ❒ 10 10 µF electrolytic capacitors [C3,4,6,19,20,21,25,32,42,44]
- ❒ 1 1000 µF electrolytic capacitor [C5]

Resistors

- ❒ 1 100 ohms (brown-black-brown) [R28]
- ❒ 1 220 ohms (red-red-brown) [R29]
- ❒ 1 270 ohms (red-violet-brown) [R22]
- ❒ 1 330 ohms (orange-orange-brown) [R30]
- ❒ 6 470 ohms (yellow-violet-brown) [R2,24,27,32,33,34]
- ❒ 1 1K ohms (brown-black-red) [R5]
- ❒ 3 2.2K ohms (red-red-red) [R10, R18*,19*] *see schematics
- ❒ 2 3.3K ohms (orange-orange-red) [R18*,19*] *see schematics
- ❒ 3 4.7K ohms (yellow-violet-red) [R12,13,21]
- ❒ 8 10K ohms (brown-black-orange) [R1,4,6,7,8,9,26,31]
- ❒ 2 33K ohms (orange-orange-orange) [R14,15]
- ❒ 1 47K ohms (yellow-violet-orange) [R25]
- ❒ 1 100K ohms (brown-black-yellow) [R23]
- ❒ 1 150K ohms (brown-green-yellow) [R20]
- ❒ 1 10M ohms (brown-black-blue) [R3]
- ❒ 2 1K ohm potentiometer (marked 102) [R16,17]
- ❒ 1 100K ohm potentiometer (MARKED 104) [R11]

Semiconductors

- ❒ 1 2N3904 NPN transistor [Q1]
- ❒ 2 2SC2570 NPN transistors [Q2,3]
- ❒ 1 1N4004 diode (black with gray band) [D15]
- ❒ 12 1N4148 diodes (small glass diodes) [D2—D13]
- ❒ 1 Varactor diode (transistor shape, two leads, marked MV2105) [D14]
- ❒ 1 LED [D1]
- ❒ 1 LM317 configured as a +3 volt voltage regulator [VR2]

- ❒ 1 78L05 +5 volt voltage regulator [VR3]
- ❒ 1 145170 Serial PLL IC [U1]
- ❒ 1 MC68HC908JK1 Microcontroller IC (marked with white sticker) [U2]
- ❒ 1 BA1404 Stereo modulator IC [U3]

Inductors
- ❒ 1 Shielded can inductor, .18µH [L1]
- ❒ 2 Axial style inductors (brown-black-gold), 1µH [L4,5]
- ❒ 2 Pre-wound spring style inductors, 79 nH inductor [L2,3]

Hardware, Misc.
- ❒ 1 6 MHz crystal (thin shiny rectangle marked 6.00 or 6M000) [X1]
- ❒ 1 38 KHz crystal (small silver cylinder with two small leads), taped to paper. [X2]
- ❒ 1 MP3FM printed circuit board
- ❒ 1 20 pin DIP socket (for U2)
- ❒ 1 18 pin DIP socket (for U3)
- ❒ 1 2.1mm DC power jack [J1]
- ❒ 2 3.5mm stereo jacks [J2,3]
- ❒ 1 Horizontal DPDT push-button switch [S1]
- ❒ 1 Small black mini push-button switch [S2]
- ❒ 3 DIP switches (8 pin dip with 4 sliding tabs) [S3,S4,S5]
- ❒ 1 2 pin header (stereo jumper) [JMP1]
- ❒ 1 Jumper block (for JMP1, stereo jumper)
- ❒ 1 Whip antenna [ANT1]
- ❒ 1 12 volt DC power transformer
- ❒ 1 3.5mm to 3.5mm stereo audio patch cable

Case and Knob Parts
- ❒ Top Cover
- ❒ Bottom Base Tray
- ❒ 4 - Short Phillips Head Screws
- ❒ 2 - Long Phillips Screws
- ❒ Front and Rear Plastic Panels
- ❒ Front and Rear Labels
- ❒ 4 - Rubber Feet
- ❒ Appropriate Knobs for Kit

Required, not supplied
- ❒ Line level audio source (such as computer line out or CD player)

RAMSEY "LEARN-AS-YOU-BUILD" ASSEMBLY STRATEGY

As you can see in examining the circuit board and components, there is a bit more to this kit than just soldering a few parts. So that you don't spend extra time "troubleshooting" instead of getting on the air, we strongly recommend that you follow the assembly strategy and step-by-step procedures we provide.

Our strategy in installing parts on our PC board is to install the larger and more obvious parts such as the connectors and controls first. These parts will then act as "landmarks" so that each additional device installed is seen in relationship to them, or to others previously installed.

In addition, we'll discuss the purpose of most of the components or groups of components as we go along. If you are new to the idea of building your own transmitter, perhaps our explanations will help you understand and learn as we go along. The assembly sequence will follow the circuit flow from input jacks to antenna as faithfully as is practical, as part of Ramsey's "Learn-As-You-Build" kit assembly philosophy.

MP3FM ASSEMBLY

Use the boxes to check off your progress.

Check all received parts against the Parts list on page 8 and 9. The parts list describes the various markings that may be found on the kit parts.

Since you may appreciate some "warm-up" soldering practice as well as a chance to put some "landmarks" on the MP3FM PC board, we'll first install some "hardware" components, to make the up-down, left-right orientation of the PC board as clear as possible.

In ALL the following instruction steps, our word "INSTALL" means this:

- Insert the part, oriented correctly, into its correct holes in the PC board.
- If helpful, gently BEND the part's wire leads or tabs to hold it in place, with the body of the part snugly against the top "component side" of the PC board. The “component side” has been silk screened (white lettering) for easy parts placement identification.
- SOLDER ALL wires or pins of the part, whether the two wires of a resistor or all pins of an IC socket.
- Nip or "trim" all excess wires extending beyond each solder connection, taking care that wire trimmings do not become lodged in PC board solder connections. Leads should always be as short as practically possible.

Enough said. . . Let's get building!

- ❒ 1. Install the 20-pin DIP socket supplied with your kit. There is no right or wrong direction to this socket, but the U2 IC itself certainly needs to be inserted correctly (later). Taking care of this socket early in the project will help you with positioning additional parts and will fine-tune your soldering technique. Before soldering, make sure the socket body is flush against the PC board, and that all 20 pins have been inserted. You can lay the board upside down on your table or bench top to be sure the socket (now underneath the board) is in flat. Bend the two corner pins to hold it in place while you are soldering. After soldering make sure that it is flat on the board. Solder all 20 pins and then CAREFULLY check to ensure you have not caused any "solder bridges" between pins.
- ❒ 2. In a similar fashion, install the 18 pin DIP socket for use with U3.
- ❒ 3. Carefully insert the microcontroller IC, U2 (marked with a white sticker) into the 20 pin DIP socket, taking gentle care that ALL 20 pins get into their proper holes. The orientation of the notched end, as shown on the Parts Layout Diagram is **critically** important. The notched end is closest to the PROGRAM button (S2) holes.
- ❒ 4. Insert U3, the BA1404 stereo modulator IC into the 18 pin DIP. The IC should be checked for orientation and bent under pins after insertion, just like the microcontroller U2 above.
- ❒ 5. Install U1 (marked 145170). This IC does not have a socket. Don’t be afraid of heating it too much. Bend the two corner pins as you did with the socket for U2. Be sure that all of the pins are through the board and not bent over on top. Place the notched end as shown on the PC board.
- ❒ 6. Install S1, the DPDT horizontal push-button switch. It fits correctly only one way. Ensure that the white plastic switch extends out over the edge of the printed circuit board. Solder all six pins.
- ❒ 7. Install S2, the small black mini push-button switch. Solder all 4 or 2 pins depending on the switch provided. This switch snaps into place and sits flush with the top of the board.
- ❒ 8. Install J2, the Line input jack. Solder all points of the jack securely.
- ❒ 9. Install J3, the Line output jack. Solder all points of the jack securely.
- ❒ 10. Install J1, the 2.1 mm external DC input jack . Solder all 3 pins.

Progress Note: The preceding steps have secured a sufficient number of components to your PC board to make general orientation around the board much clearer for installing additional parts. Further parts will be installed in six phases or groupings.

Audio Input Circuits

We encourage you to refer to the schematic diagram and learn the functions of the following parts. If you wish, insert the parts groupings as one operation, then solder and nip all connections.

Most of the resistors will be installed in a stand up fashion. That is, one lead will go straight into the board while the other is bent around to go back down into the other hole. The straight lead, where the body of the resistor is, goes into the hole with the circle around it.

- ❒ 1a. Install R16, one of the small yellow 1K trimmer potentiometers marked "102". Don't confuse it with R11 which is marked "104".
- ❒ 2a. Install R17, the other yellow 1K trimmer marked "102". These two trimmers will allow you to fine tune the input audio level.
- ❒ 3a. Install R13, a 4.7K ohm resistor (yellow-violet-red).
- ❒ 4a. Install R14, a 33K ohm resistor (orange-orange-orange).
- ❒ 5a. Install R15, a 33K ohm resistor (orange-orange-orange).
- ❒ 6a. Install R12, a 4.7K ohm resistor (yellow-violet-red).

For use in Europe, use 2.2K ohm resistors in steps 7a and 8a. These resistors set the pre-emphasis characteristic for the MP3FM. Pre-emphasis is a technique used in FM transmitters to increase the high frequency signal to noise ratio.

- ❒ 7a. Install R18, 3.3K (orange-orange-red).
- ❒ 8a. Install R19, 3.3K (orange-orange-red).
- ❒ 9a. Install C15, .022µF disc capacitor (marked .022 or 223).
- ❒ 10a. Install C16, .022 µF disc capacitor (marked .022 or 223).

Electrolytic capacitors have a right and wrong way to be installed. Usually, capacitors have a wide black stripe which indicates their negative lead and the PC board or Parts Layout Diagram will show the positive side of the capacitor's installation hole. Be sure to place the (+) capacitor lead into the PC board (+) hole and the (-) lead into the (-) hole. Observe correct polarity when installing the following three electrolytic capacitors:

- ❒ 11a. Install C19, 10 µF electrolytic capacitor. Don’t forget... the proper orientation is noted on the PC board or Parts Layout Diagram.
- ❒ 12a. Install C20, 10 µF electrolytic capacitor. Observe correct polarity.
- ❒ 13a. Install C21, 10 µF electrolytic capacitor. Remember correct polarity.
- ❒ 14a. Install C13, a .001µF ceramic capacitor (marked .001, 102 or 1nF).

❒ 15a. Install C14, a .001µF ceramic capacitor (marked .001, 102 or 1nF).

❒ 16a. Install C17, a .01µF ceramic capacitor (marked .01 or 103 or 10 nF).

❒ 17a. Install C18, a .01µF ceramic capacitor (marked .01 or 103 or 10 nF).

Power Supply

❒ 1b. Install C5, the large 1000 µF electrolytic capacitor. Be sure to position for correct polarity.

❒ 2b. Install VR3, the 78L05 5 volt regulator. Make sure the flat side of the component is facing the same direction as shown in the parts layout.

❒ 3b. Install VR2, the LM317 +3 volt voltage regulator. Make sure the flat side of the component is facing the same direction as shown.

❒ 4b. Install R29, 220 ohms (red-red-brown).

❒ 5b. Install R30, 330 ohms (orange-orange-brown).

❒ 6b. Install C40, a .001µF ceramic capacitor (marked .001, 102 or 1nF).

❒ 7b. Install L4, a 1µH inductor (brown-black-gold).

❒ 8b. Install L5, the other 1µH inductor (brown-black-gold).

❒ 9b. Install C41, .001µF ceramic capacitor (marked .001, 102 or 1nF).

❒ 10b. Install D15, 1N4004 diode (black with gray band). Be sure to orient the banded end as shown on the PC board silkscreen and parts layout diagram.

❒ 11b. Install C3, a 10µF electrolytic capacitor. Pay attention to polarity of this part and the following electrolytic caps!

❒ 12b. Install C42, a 10µF electrolytic capacitor.

❒ 13b. Install C44, a 10µF electrolytic capacitor.

❒ 14b. Install C4, yet another 10µF electrolytic capacitor.

Transmitter

❒ 1c. Install R11, the small yellow 100K trimmer potentiometer marked "104".

❒ 2c. Install R21, 4.7K (yellow-violet-red).

❒ 3c. Install R20, 150K (brown-green-yellow).

❒ 4c. Install C24, 220 pF disc capacitor (marked 220 or 221 or 220K).

❒ 5c. Install C25, 10µF electrolytic capacitor. Observe polarity.

❒ 6c. Install C26, .001 µF disc capacitor (marked .001 or 102).

❒ 7c. Install C12, a .001 µF disc capacitor (marked .001 or 102).

- ❒ 8c. Install C28, 5 pF disc capacitor (marked 5 or 5K).
- ❒ 9c. Install C27, 5 pF disc capacitor (marked 5 or 5K).
- ❒ 10c. Install C30, .01 µF disc capacitor (marked .01 or 103 or 10 nF).
- ❒ 11c. Install R23, 100K ohms (brown-black-yellow).
- ❒ 12c. Install D14. It looks like a transistor with only two leads (marked MV2105). Notice the placement of the flat side, it should face R23.
- ❒ 13c. Install R24, 470 ohms (yellow-violet-brown).
- ❒ 14c. Use a scrap piece of wire from one of the components you have installed and solder it in the hole marked TP1. Later you will use this free-standing wire to measure the VCO voltage at this point and tune the unit.
- ❒ 15c. Install C32, 10 µF electrolytic capacitor. Observe polarity.
- ❒ 16c. Install shielded slug tuned coil L1. The larger tabs secure the shield can to the ground foil connections, while the two thin leads are the coil connections. If you find that the coil lead wires do not line up with the PC board holes, simply "pull" the coil insert from the shield can, rotate it a quarter-turn and insert back into the can. Make sure L1 is squarely against the top of the PC board before soldering. Solid installation of L1 is essential to the frequency stability of your transmitter.
- ❒ 17c. Install R25, 47K ohms (yellow-violet-orange).
- ❒ 18c. Install C31, .1 µF disc capacitor (marked 104 or .1).
- ❒ 19c. Install C29, a .001 ceramic capacitor (marked .001 or 102 or 1 nF).
- ❒ 20c. Install R22, 270 ohms (red-violet-brown).
- ❒ 21c. Install C33, .001 µF (marked .001 or 102 or 1 nF).
- ❒ 22c. Install C22, 10 pF disc capacitor (marked 10 or 10K).
- ❒ 23c. Install C23, 10 pF disc capacitor (marked 10 or 10K).
- ❒ 24c. Install C11, .1 µF disc capacitor (marked 104 or .1).
- ❒ 25c. Install X2, the small silver "can" crystal. Be especially careful when installing this part as its leads are very small. You may elect to put a small "dab" of glue on the part to relieve stress and to keep it firmly attached to the PC board or use a piece of clipped off lead and form a loop to go around the crystal and through the holes in the board.
- ❒ 26c. Install JMP1, a 2 pin header. A jumper block will be installed on this to enable stereo transmission.

RF Amplifier

- ❒ 1d. Install Q2, the transistor marked C2570 (or 2498). The flat side must be placed as shown on the PC board, facing away from R27. Mount Q2 as

close to the board as possible without forcing it.

- ❒ 2d. Install R26, 10K ohms (brown-black-orange).
- ❒ 3d. Install R33, 470 ohms (yellow-violet-brown).
- ❒ 4d. Install R27, also 470 ohms (yellow-violet-brown).
- ❒ 5d. Install C34, .01 µF (marked .01 or 103 or 10 nF).
- ❒ 6d. Install C35, .001 µF disc capacitor (marked .001 or 102 or 1 nF).
- ❒ 7d. Install R10, 2.2K ohms (red-red-red).
- ❒ 8d. Install R31, 10K ohms (brown-black-orange).
- ❒ 9d. Install Q3, the other transistor marked C2570 (or 2498). Again watch the placement of the flat side and mount as flush as possible.
- ❒ 10d. Install R32, 470 ohms (yellow-violet-brown).
- ❒ 11d. Install R34, 470 ohms (yellow-violet-brown).
- ❒ 12d. Install C10, .01 µF (marked .01 or 103 or 10 nF).

RF Lowpass Filter

- ❒ 1e. Install C37, a 47 pF ceramic capacitor (marked 47 or 47K).
- ❒ 2e. Install C43, a .001µF ceramic capacitor (marked .001, or 102). This is a coupling capacitor for preventing DC from being present on the antenna.
- ❒ 3e. Install L2, one of the small red pre-wound spring style inductors.
- ❒ 4e. Install L3, the other small red pre-wound spring style inductor.
- ❒ 5e. Install C38, a 75 pF ceramic capacitor (marked 75 or 75K).
- ❒ 6e. Install C39, a 47 pF ceramic capacitor (marked 47 or 47K).

Synthesizer

- ❒ 1f. Install C36, .001 µF disc capacitor (marked .001 or 102 or 1 nF).
- ❒ 2f. Install R28, 100 ohms (brown-black-brown).
- ❒ 3f. Install R6, 10K ohms (brown-black-orange).
- ❒ 4f. Install R7, 10K ohms (brown-black-orange).
- ❒ 5f. Install R8, 10K ohms (brown-black-orange).
- ❒ 6f. Install R9, 10K ohms (brown-black-orange).
- ❒ 7f. Install D2 - D13, small glass diodes. The banded ends go toward the center of the board, as shown on the silkscreen.
- ❒ 8f. Install S3, a four position DIP switch. The DIP switches are used for programming the exact transmitting frequency of your transmitter.

- ❒ 9f. Install S4 and S5 in the same manner.
- ❒ 10f. Install X1, the 6.00 MHz crystal (marked 6.00 or 6M000)
- ❒ 11f. Install R3, 10M ohm (brown-black-blue).
- ❒ 12f. Install C1, 27 pF disc capacitor (marked 27 or 27K).
- ❒ 13f. Install C2, 27 pF disc capacitor (marked 27 or 27K).
- ❒ 14f. Install C9, .1 µF disc capacitor (marked 104 or .1 or 100 nF).
- ❒ 15f. Install R4, 10K ohms (brown-black-orange).
- ❒ 16f. Install R5, a 1K ohm resistor (brown-black-red).
- ❒ 17f. Install C8, .01 µF disc capacitor (marked 103 or .01 or 10 nF).
- ❒ 18f. Install R1, 10K ohms (brown-black-orange).
- ❒ 19f. Install Q1, the transistor marked 2N3904. The flat side must be placed as shown on the PC board, facing away from C8. Mount it as close to the board as possible without forcing it.
- ❒ 20f. Install C6, 10 µF electrolytic capacitor. Check polarity!
- ❒ 21f. Install R2, 470 ohms (yellow-violet-brown).
- ❒ 22f. Install C7, .1 µF (marked .1 or 104 or 100 nF).
- ❒ 23f. Install D1, the LED. The flat side goes toward switch S1. Leave it standing about 1/2 an inch off of the board when soldering. After soldering bend it over to a 90º angle at it's mid point so that it faces the outside of the board. D1 indicates that the frequency is locked.

ASSEMBLY INSTRUCTIONS FOR CUSTOM CASE

The enclosure is a key element to the overall pride you will have upon completing your Ramsey kit. The enclosure will show how you were able to "build from scratch" a commercial piece of high-tech electronics. For some of us, the enclosure will also hide a number of "not-so-pretty" assembly mistakes. Once the kit is enclosed, your friends will never know that you were new to soldering. Finally, the enclosure case will protect your electronics from many possible causes of damage so that you can receive years worth of enjoyment using, talking about, and remembering the fun you had building your kit. In short, TAKE YOUR TIME when assembling the enclosure. This is the part that you and your friends will look at and admire for years!

- ❒ 1. Lay the front and rear plastic plates over their corresponding labels.
- ❒ 2. Outline the holes that you need to cut using a pen or pencil.
- ❒ 3. Use your hobby knife or paper punch to cut the labels to their outlines.
- ❒ 4. Peel off the sticker backing on each sticker and place the labels over the

plastic plates. Make sure that they are aligned correctly before allowing them to touch the plastic plates. They stick the first time, line them up right!

- ❒ 5. Insert the board into the case with the knobs and LED extending through the holes in the front panel.
- ❒ 6. Raise the rear portion of the PC board and extend the jacks through the rear plastic plate. Insert the plate into the grooves on the base tray.
- ❒ 7. Secure the PC board to the bottom base tray with 4 short Phillips head screws.

CHOOSING AN OPERATING FREQUENCY

(A) It really is NOT sufficient to just "check" the FM band for an empty frequency, using the FM portable radio closest at hand. It is your responsibility to carefully research what FM stations can be listened to with a good system within the transmitting range of your MP3FM. This is especially important in the low end of the FM broadcast band (88-92 MHz), where there are numerous medium power National Public Radio stations. You may not be aware of these stations but your neighbors may be receiving them, using a good receiver and outdoor antenna. Interfering with such reception is a direct violation of federal law. The most reliable way of finding a truly open frequency on the FM band is to check the band with a very good FM receiving system using an external antenna. If you do not have access to such a radio, most modern car radios (with exterior antenna) are very sensitive and usable to help you know what stations your neighbors really can be receiving on a particular frequency.

(B) In choosing an operating frequency, remember that most "digital-tuning" receivers, whether portable, mobile or hi-fi, are designed to tune in 200 KHz increments and therefore might not receive well a signal operating between these pre-tuned standard broadcasting frequencies. In order to comply with Part 15 of FCC regulations, it is your responsibility to determine carefully that your operation will not cause interference to broadcast reception. Please study Appendix A of this manual before using your MP3FM.

ADJUSTING YOUR MP3FM TRANSMITTER

Keep all tests very brief until you have carefully chosen an open operating frequency in the FM broadcast band.

1. Transmitting Frequency

After finding a suitable "open" frequency in the 88-108 MHz FM band, program DIP switches S3, S4, and S5 for the frequency desired and then momentarily depress the ‘Program’ button. The DIP switches are programmed in BCD, a form of binary that is very easy to use. Look at your circuit board or parts layout diagram, you’ll see the numbers 1, 2, 4, 8 printed next to each DIP switch. On these switches you add up the closed positions to make to make any number

between 0 and 9. For example: closing position 1 and 8 on S3 (10 MHz switch) is equal to 90 MHz (1+8=9, 9x10 MHz = 90 MHz), closing 2 and 4 on S4 (1 MHz switch) is equal to 6 MHz (2+4=6, 6x1 MHz = 6 MHz), closing 4, 2 and 1 on S5 (0.1 MHz switch) is equal to 0.7 MHz (4+2+1=7, 7x .1 MHz = .7 MHz). This makes the final frequency equal to 96.7 MHz (90+6+.7=96.7). These switches may be set to any frequency between 88 and 108 MHz. To set the frequency above 100 MHz, the S3 positions must add up to ten, you would close 8 and 2 (8+2=10). Any switch setting greater than 9, with the exception of S3, is invalid and will be read as 0.

After setting your DIP switches, recheck your ‘math’, depress the Program button and listen on a nearby FM radio for the carrier frequency. No audio input is needed to make this first adjustment, you can simply listen for a "quieting" in the normal background noise "hiss." Remember that if you have adjusted the MP3FM outside of 88 MHz to 108 MHz range it will default to 88.1 MHz. This means that if you can’t hear anything on the radio near the frequency you are trying to transmit at, go to 88.1 MHz and see if it is there.

If you still can’t receive anything then check the voltage at TP1. TP1 is located just off the lead of R24 that is closest to the outside of the board. With an operating frequency of 107.9 MHz programmed into the DIP switches, there should be around 4.5 volts at TP1. If there isn’t, adjust L1 until you read 4.5 volts. With a frequency of 88.1 MHz programmed into the DIP switches, you should read about 0.5 volts at TP1. If you can’t get either reading, see the troubleshooting section.

2. Audio Connection

Adjust both Left and Right level potentiometers (R16, R17) to about half of their rotation. This is a good starting position. The best audio input for both testing and general operation are the stereo "line-level outputs" of a cassette deck or CD player. Most stereo systems have a variety of auxiliary output jacks of which one or more are line-level outputs.

Hooking up an audio source to your MP3FM is really quite simple. However, there are some general rules:

- A terribly distorted sound is a sign of too much audio level. Simply rotate the level potentiometers R16 and R17, CCW to reduce the level. Make sure you rotate each one about the same amount to maintain proper stereo balance.

- NEVER connect the MP3FM audio inputs to speaker outputs of a high power stereo system; such a connection will destroy the IC chip.

- Consider using a mike mixer for professional "radio station" sound. It will allow you to easily fade, mix and switch between various audio sources.

3. Stereo balance

Adjust R11 for correct stereo balance. If you are transmitting in stereo adjust R11 to its center position. The better your ear for music and your understanding of quality audio devices and interconnections, the better will be the performance of your MP3FM.

USING THE MP3FM WITHIN THE HOME

Typical use for the MP3FM would be to connect it to a personal computer within a large home so that whatever MP3 or other audio files that are playing can also be tuned-in on portable FM radios in other rooms, the garage or in the yard.

This connection consists of using shielded audio cables to connect the line or speaker level output to the audio inputs of the MP3FM. Consult the literature that came with your stereo equipment.

Even if you intend use of the MP3FM for your own home and family, it is still your responsibility, in accordance with Part 15 of the FCC Rules, to ensure that this operation does not cause interference to your neighbors.

EXPERIMENTAL "BROADCASTING" PROJECTS

To use the MP3FM successfully as a "broadcasting" service to interested listeners in a school or immediate neighborhood, most of your effort will be concentrated on smoothly "managing" or mixing the audio signals fed into the transmitter input. Operation of the transmitter itself consists simply of the following:

1. Correct construction and adjustment.
2. Carefully checking for an open frequency between 88-108 MHz in accordance with FCC Rules, Part 15.
3. Setting up a suitable antenna.
4. Connecting the audio source to the input jack.
5. Turning on the transmitter while you intend to be "on the air" and turning it off when you are finished.

TROUBLESHOOTING GUIDE

If your MP3FM does not work at all, re-check the following:

- correct orientation of U1, U2, and U3 (see PC board layout diagram)
- correct polarity of all electrolytic capacitors.
- correct orientation of diodes D2 - D15
- correct orientation of Q1, Q2, and Q3 transistors,
- all solder connections.

Hints

- Erratic or unstable operation is caused by faulty solder joints or cable connections.
- Replacement stereo transmitter IC chips may be ordered from Ramsey Electronics, Inc.
- The 2SC2570 transistor is a bipolar silicon NPN low-noise UHF/VHF amplifier in a TO-92 BEC case, suitable for service up to 5 GHz. Standard 2SC2570 replacements: ECG10 or SK9139, which may be found at most local electronics parts dealers.

APPENDIX A: FCC RULES AND INFORMATION

The Rules of the FCC (Federal Communications Commission) and your kit built FM Stereo Transmitter.

An interim explanation of applicable FCC regulations supplied as a personal assistance to MP3FM builders, by Dan F. Onley (K4ZRA)

It is the policy of Ramsey Electronics, Inc., that knowing and observing the lawful use of all kits is a first responsibility of our kit user/builders. We do not endorse any unlawful use of any of our kits, and we try to give you as much common sense help about normal and lawful use as we can. Further, it is the policy of Ramsey Electronics, Inc., to cooperate with all applicable federal regulations in the design and marketing of our electronics kit products. Finally, we urge all of our overseas customers to observe the regulations of their own national telecommunications authorities.

In all instances, compliance with FCC rules in the operation of what the FCC terms an "intentional radiator" is always the responsibility of the user of such an "intentional radiator".

To order your copy of FCC rules part 15, call the US Government, Superintendent of Documents, at 202-512-1800, or fax at 202-512-2250. To order the correct document, ask for “CFR Title 17: Parts 1 to 199.” The cost is about $24.00. Master Card and Visa are accepted.

In the United States, this is how the FCC regards your transmitter kit

Licensed FM broadcast stations and their listeners have ALL the rights! Your use of a device such as the MP3FM kit MAY have some limited privileges in locally-unused band space, but your non-licensed use of the MP3FM has absolutely NO rights at all over the rights of licensed broadcast operators and the rights of their listeners to interference-free reception. If your operation of a device such as the MP3FM interferes with ANYBODY'S use or enjoyment of an FCC licensed transmission of any kind, your only choice is to IMMEDIATELY terminate or change the operation of your low-power transmitting device so as to cause no more interference. That's it! No discussion, no exceptions.

Unlicensed operation of small transmitting devices is discussed in "Part 15" of the FCC Rules. These Rules are published in 100 "Parts," covering everything imaginable concerning the topic of "Telecommunications." The six books containing the FCC Rules are section 47 of the complete Code of Federal Regulations, which you are likely to find in the Reference section of your Public Library. If you have questions about the legal operation of your MP3FM or any other kit or home-built device which emits RF energy, it is your responsibility to study the FCC regulations. It is best if YOU read (and consult with a lawyer if you are in doubt) the rules and do not bother the understaffed and busy FCC employees with questions that are clearly answered in the rules.

Here are the primary "dos and don'ts" picked from the current FCC Rules, as of May, 1990. This is only a ***brief look*** at the rules and should not be construed to be the absolute complete legal interpretation! It is up to you to operate within the proper FCC rules and Ramsey Electronics, Inc. cannot be held responsible for any violation thereof.

1. In the past, no "two-way communications" use of the 88-108 MHz FM broadcast band was permitted. This prohibition does not appear in the current edition of Part 15. Previous editions of Part 15 discussed "wireless microphones" (such as Ramsey FM-1, FM-4, etc.), while the June 23, 1989, revision eliminates this discussion in favor of more detail regarding computer and TV peripherals and other modern electronic conveniences. However, it is not immediately clear that the 1989 revision of the FCC Rules Part 15 necessarily "cancels" previous regulations. Laws and rules tend to remain in force unless they are specifically repealed. Also, FCC Rule 15.37 discusses "Transitional Provisions for Compliance with the Rules," and states in item (c): "There are no restrictions on the operation or marketing of equipment complying with the regulations in effect prior to June 23, 1989."

2. It is the sole responsibility of the builder-user of any FM broadcast-band device to research and fully avoid any and all interference to licensed FM broadcast transmission and reception. This instruction manual gives you practical advice on how to do a good job of finding a clear frequency, if one is available.
3. For some frequency bands, the FCC sets 100 milliwatts (0.1 watt) as the maximum permitted power output for unlicensed, home-built transmitting devices, and that the combined length of your antenna and feedline (coaxial cable or other) must not exceed 10 feet. The technical standards for 88-108 MHz are very different, primarily concerned with band width and RF field strength.
4. FCC Rules do not differ for "stereo" or "monaural" transmissions.
5. Broadcasting on the grounds of a school (AM emissions only) is specifically permitted and encouraged between 525 and 1705 KHz under Part 15.221. Use our AM-1 AM radio broadcast kit for this use.
6. FCC Rule No. 15.239 specifically addresses operation in the 88-108 MHz FM broadcast band for which your MP3FM transmitter kit is designed. However, this Rule does not, by itself, tell you everything you need to know about using a device of this kind. Therefore, we are noting a series of Part 15 regulations which should be observed:

- a. The "bandwidth" of your transmission is limited to 200 KHz, centered on the actual operating frequency. Since 200 KHz is enough spectrum space for several different FM stations, this is a "generous" limitation designed to accommodate cruder FM devices. Properly built and adjusted, the MP3FM kit operates well within this limit. In fact, its signal should sound no "wider" than any other FM station when listening on an ordinary FM radio.

- b. FCC Rule 15.215(a) says: "Unless otherwise stated, there are no restrictions as to the types of operations permitted under these sections." This general provision appears to leave you free to use your FM stereo transmitter in a manner similar to operations of an FM broadcasting station, or to use it for any other non-interfering, practical application.

- c. FCC Rule 15.5: General conditions of operation: "(b) Operation...is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical equipment, or by an incidental radiator. (c) The operator of a radio frequency device shall be required to cease operating the device upon notification by a Commission representative that the device is causing harmful interference."

- d. The most specific FCC regulation of 88-108 MHz FM Broadcast band unlicensed operation is that the "field strength" of the signal must not

exceed 250 microvolts/meter at a distance of 3 meters from the transmitter (FCC rule 15.239). If you have any concern about this emission limit, have your device checked by a technician with accurate measuring equipment. Remember that the "field strength" of a signal is determined as much by the antenna as by the RF output of the transmitter itself.

APPENDIX B: UNDERSTANDING LEGAL "FIELD STRENGTH"

The new FCC Part 15 Rules specify a maximum "Field Strength" of your transmitted signal. Since it is unlikely that you have the equipment to carry out accurate field strength measurements in microvolts, it is useful to understand at least the theory of field strength so that you can understand both what you can expect from such transmitters, and what limits the FCC intends.

Previous limits on nonlicensed FM-broadcast band devices were defined as a maximum field strength of 40μV per meter measured at a distance of 15 meters. The June 1989 revised rule specifies a maximum of 250 μV per meter, but measured at 3 meters from your antenna. Both limitations are the same in practice. "250μV per meter" means that an accurate field-strength meter with a 1-meter antenna may indicate a maximum signal field strength of 250μV (In contrast, non-licensed operation from 26.96 to 27.28 MHz is limited to a field strength of 10,000 μV per meter at 3 meters).

In all cases, the field strength of a signal decreases in direct proportion to the distance away from the antenna. Power decreases by the square of distance: for every doubling in distance, the signal power is quartered, but the field strength voltage is only halved. Using this theory, we can construct a simple chart to show the maximum permitted performance of a non-licensed FM band transmitter. The theoretical figures assume a simple 1 meter receiving antenna in all cases and do not take into consideration that reception can be greatly enhanced with larger, multi-element antennas and preamplifiers. In the following chart, the field strength (theoretical minimum) gets even stronger as you move from the edge of these circular boundaries toward the antenna:

This "exercise in meters and microvolts" demonstrates that the FCC clearly intends to limit the theoretical range of non-licensed devices operating in this band. It also shows the potential for causing interference at a home down the street from you. But it also shows that you can legally put out quite a good signal over wider areas than you might have imagined.

For other kinds of radio services, the FCC restricts such factors as transmitter power or antenna height, which cannot really limit the possible "range" of a transmission under good conditions. By restricting the maximum field strength at a specific distance from your antenna, the FCC clearly plans for your signal to "die out" at a specific distance from your antenna, no matter what kind of transmitter power or extra-gain antenna you are using. On the other hand, the FCC standards do make it legal and possible for you to broadcast on a school

campus, campground or local neighborhood, as long as you do not cause interference to broadcast reception.

“Why talk about acres"?

There are three reasons to translate our look at "field strength" into "acres".

1. The first one is easy: the numbers would get too cumbersome if we discussed your possible signal coverage in terms of square feet or square meters.
2. It's very easy to see that your signal can easily and legally serve a school campus or wilderness campground.
3. And, if we remember that typical urban single-family home sites run from 1/4 to 1/2 acre on the average, it should become extremely clear that your obligation to avoid interfering with broadcast reception can easily involve hundreds of homes, before adding apartments!

In fact, the most significant distance in the above chart is the 1.9 µV signal strength permissible at 1260 feet (about 1/4 mile), covering a circular area of about 114 acres. A quick glance at stereo FM receiver specifications shows typical sensitivity of 1.7 µV before considering high-gain antennas or preamplifiers. Your non-licensed signal can provide serious competition to a public broadcast station fifty miles away, a station which someone in your neighborhood may have set up a special antenna to enjoy.

Calibrated "field strength meters" such as described in the ARRL Radio Amateur's Handbook can detect signals down to about 100 microvolts. To measure RF field strength below such a level, professional or laboratory equipment and sensitive receivers are required. A "sensitive" receiver responds to a signal of 1 or even .5 microvolts "delivered" to the receiver input by antenna. If the antenna is not good, the receiver cannot respond to the presence of fractions of a microvolt of RF energy.

SUMMARY

The present edition of Part 15 of the FCC rules does not provide detailed guidance on ALL aspects of using a low-power transmitter such as the MP3FM. The main point is that you may not cause any interference whatsoever to licensed broadcast services and that you must be willing to put up with any interference that you may experience.

In addition to operations not requiring authorization, you also have the option of writing a clear and polite letter to the FCC Engineer-in-Charge of your local district, describing your intended operation. Mention the operating frequency and planned hours of operation. This could be a good step to take if your project is in behalf of a school, Scout or community group.

If you become further fascinated with the service rendered by low-power broadcasting, other FCC regulations explain how to apply for a license or other authorization which may permit you to upgrade your MP3FM or other equipment to accomplish any objective which the FCC sees to be in the public interest and not interfering with other authorized uses of the radio spectrum.

DISTANCE FROM TRANSMITTER ANTENNA			
METERS	**FEET**	**FIELD**	**TOTAL AREA**
3	10	250	314 FT
6	20	125	1256 FT
12	39	63	4800 FT
24	78	31	19113 FT
48	157	15	1.8 ACRES
96	315	7.5	7.2 ACRES
192	630	3.8	28.6 ACRES
384	1260	1.9	11.4 ACRES
768	2520	.95	458 ACRES
1536	5036	.5	1830 ACRES

Lawful use suggestions

1. Build and adjust this kit strictly according to the published instructions.
2. Use the whip antenna supplied with the Ramsey case set, CFM.
3. Do not modify your kit in any way.
4. Check your intended operating frequency very carefully, as clearly explained in this instruction manual, to ensure you will not cause interference to reception of licensed broadcasting.
5. If you receive ANY complaint about your transmissions interfering with broadcast reception, stop or change your operation IMMEDIATELY.
6. If you are contacted by the FCC regarding use of this device, cooperate fully and promptly.
7. Do your own homework and research to understand and comply with present and future FCC rulings concerning devices of this kind.
8. Do not use made-up "station call signs" to identify your transmissions. Only

the FCC has the authority to issue such callsigns. Use some other way to identify your transmitting activity, such as "This is Stereo 90.5, Seabreeze School Student Music Radio," and so forth.

9. Identify the location and purpose of your transmissions from time to time. This is common courtesy toward other persons who may hear your signal. The FCC is toughest about clandestine transmission which cost time and money to track down.

10. Do not assume that the mere fact that you purchased this kit gives you any specific right to use it for any purpose beyond generating a low-level RF signal which is barely detectable beyond the perimeter of your personal dwelling space.

Finally, the FCC Rules call for the posting of printed notices on devices intended for non-licensed operation under Part 15 Rules. You will find such notices written up for the front or back of the instruction manual for nearly any computer or video accessory that you have seen in recent months. Consult the Part 15 Rules for the exact wording of such notices. Following is a text for such a notice which responds to FCC rule making intentions:

NOTICE:

The radio-frequency "intentional radiator" device which may be constructed from kit parts supplied by us is intended and designed by Ramsey Electronics, Inc. to conform to applicable provisions of Part 15 of FCC Rules. The individual kit-builder and all users of this device assume responsibility for lawful uses conforming to FCC Part 15 Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

Final comment

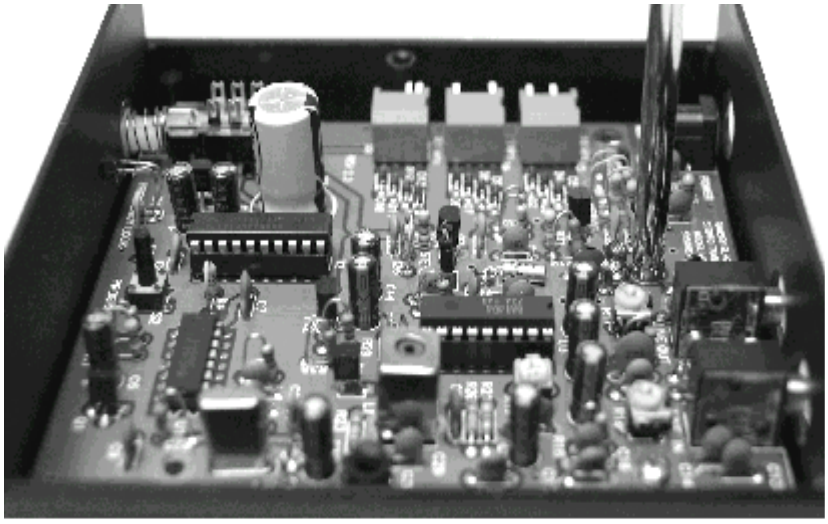
A well-informed person will see today's FCC Rules to be evolving and progressively less-restrictive. Even though today's technology is far more complex than what was possible at the time of the Communications Act of 1934, the FCC rules are becoming more relaxed, giving radio experimenters more and more opportunities to explore many frequency bands, using many communications modes, with no need for a formal license of any kind. A thorough study of Part 15 of the FCC Rules, which is completely beyond the purpose of this kit manual, will show you many legal uses of radio transmitting devices which do not require licensing, either amateur or commercial.

To provide more personal and club radio-learning opportunities, and to cut down on administrative costs, today's FCC permits far more non-licensed

activity than at any time in previous history. On the other hand, today's FCC enforcement actions get bigger fines and real prison terms for scofflaws! From CB (now 3 bands of it, for varying applications) to easy entry-level Amateur Radio with long-term licensing, to numerous unlicensed Part 15 operations, the FCC is beginning to look out for the interest and good plans and intentions of private citizens and school-community groups as never before in radio communications history. Learn the rules...observe them...and have fun in radio!

If you enjoyed this Ramsey kit, there's plenty more to choose from in our catalog - call today or visit us at www.ramseyelectronics.com!

An inside view: (Keep those parts low to the board!)



The Finished Product!!

The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully. All information required to properly build and test your kit is contained within the pages!

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit, Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part(s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of $18.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.

The repair is $36.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

SYNTHESIZED STEREO TRANSMITTER KIT
Quick Reference Page Guide

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REQUIRED TOOLS

- Soldering Iron Ramsey #RTS06, (Radio Shack #RS64-2072)
- Thin Rosin Core Solder Ramsey #RTS12, (RS64-025)
- Needle Nose Pliers Ramsey #RTS05, (RS64-1844)
- Small Diagonal Cutters Ramsey #RTS04, (RS64-1845)
  <OR> Complete Soldering Tool Set (RS64-2801)

ADDITIONAL SUGGESTED ITEMS

- Soldering Iron Holder/Cleaner (RS64-2078)
- Holder for PC Board/Parts Ramsey #RTS13, (RS64-2094)
- Desoldering Braid Ramsey #RTS08, (RS-2090)

Price: $5.00
Ramsey Publication No. MMP3FM
Assembly and Instruction manual for:
RAMSEY MODEL NO. MP3FM

RAMSEY ELECTRONICS, INC.
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TOTAL SOLDER POINTS
326

ESTIMATED ASSEMBLY TIME
Beginner ..... 10 hrs
Intermediate ..... 6 hrs
Advanced..... 4 hrs